



WORKSHEET

Representing Data Question – Histograms

Question Description: Every year in your Statistics 1 exam there is a question on Representing Data. Below is all the exam questions of when they ask you to represent data by “drawing a histogram”.

QUESTIONS

Q1 s2015_p61

The table summarises the lengths in centimetres of 104 dragonflies.

Length (cm)	2.0 – 3.5	3.5 – 4.5	4.5 – 5.5	5.5 – 7.0	7.0 – 9.0
Frequency	8	25	28	31	12

- (i) State which class contains the upper quartile. [1]
- (ii) Draw a histogram, on graph paper, to represent the data. [4]

Q2 s2015_p63

Seventy samples of fertiliser were collected and the nitrogen content was measured for each sample. The cumulative frequency distribution is shown in the table below.

Nitrogen content	≤ 3.5	≤ 3.8	≤ 4.0	≤ 4.2	≤ 4.5	≤ 4.8
Cumulative frequency	0	6	18	41	62	70

- (i) On graph paper draw a cumulative frequency graph to represent the data. [3]
- (ii) Estimate the percentage of samples with a nitrogen content greater than 4.4. [2]
- (iii) Estimate the median. [1]
- (iv) Construct the frequency table for these results and draw a histogram on graph paper. [5]

Q3 w2015_p61

Robert has a part-time job delivering newspapers. On a number of days he noted the time, correct to the nearest minute, that it took him to do his job. Robert used his results to draw up the following table; two of the values in the table are denoted by a and b .

Time (t minutes)	60 – 62	63 – 64	65 – 67	68 – 71
Frequency (number of days)	3	9	6	b
Frequency density	1	a	2	1.5

- (i) Find the values of a and b . [3]
- (ii) On graph paper, draw a histogram to represent Robert's times. [3]

Q4 w2015_p63

The heights to the nearest metre of 134 office buildings in a certain city are summarised in the table below.

Height (m)	21 – 40	41 – 45	46 – 50	51 – 60	61 – 80
Frequency	18	15	21	52	28

- (i) Draw a histogram on graph paper to illustrate the data. [4]
- (ii) Calculate estimates of the mean and standard deviation of these heights. [5]

Q5 w2016_p62

The number of people a football stadium can hold is called the 'capacity'. The capacities of 130 football stadiums in the UK, to the nearest thousand, are summarised in the table.

Capacity	3000–7000	8000–12 000	13 000–22 000	23 000–42 000	43 000–82 000
Number of stadiums	40	30	18	34	8

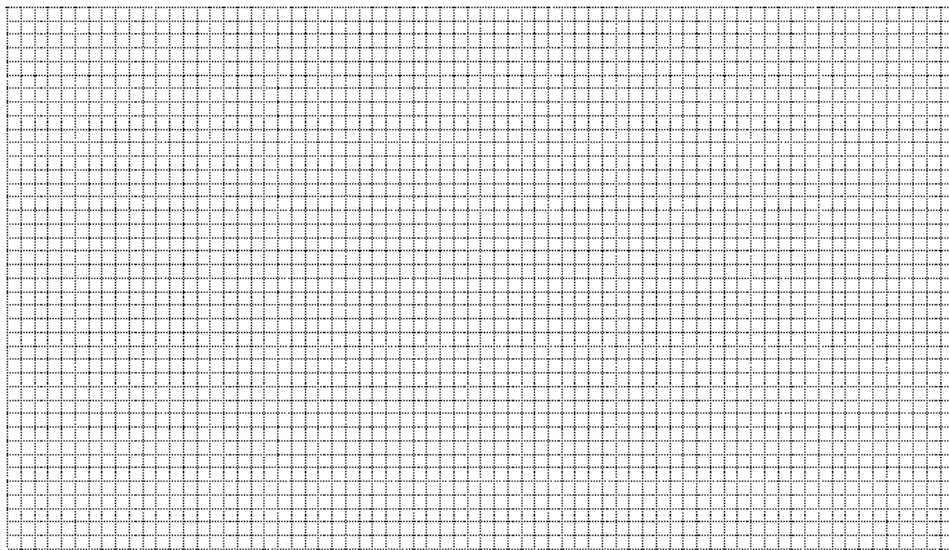
- (i) On graph paper, draw a histogram to represent this information. Use a scale of 2 cm for a capacity of 10 000 on the horizontal axis. [5]
- (ii) Calculate an estimate of the mean capacity of these 130 stadiums. [2]
- (iii) Find which class in the table contains the median and which contains the lower quartile. [2]

Q6 s2017_p61

The times taken, t seconds, by 1140 people to solve a puzzle are summarised in the table.

Time (t seconds)	$0 \leq t < 20$	$20 \leq t < 40$	$40 \leq t < 60$	$60 \leq t < 100$	$100 \leq t < 140$
Number of people	320	280	220	220	100

- (i) On the grid, draw a histogram to illustrate this information. [4]



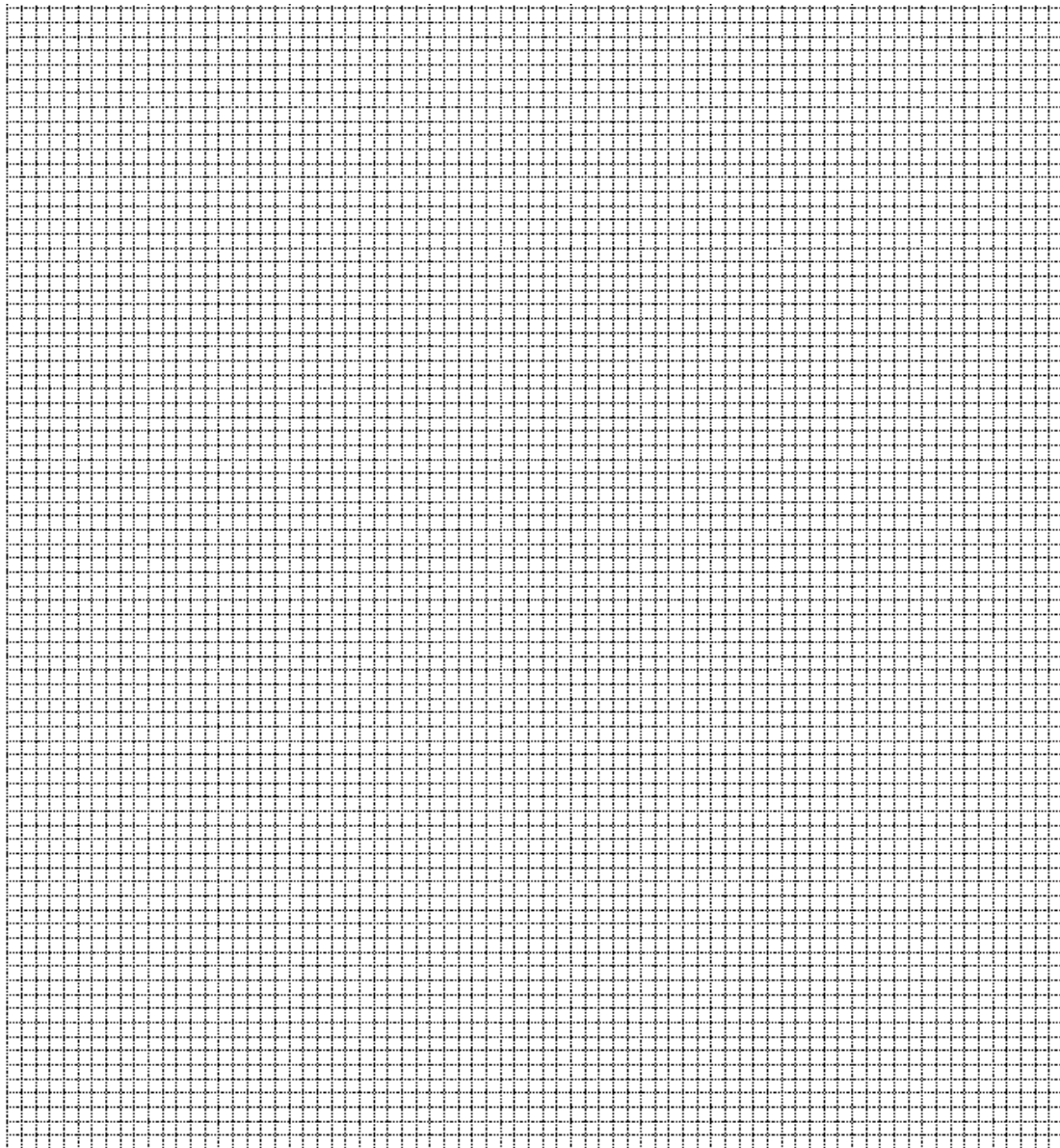
- (ii) Calculate an estimate of the mean of t . [2]

Q7 s2018_p62

The lengths, t minutes, of 242 phone calls made by a family over a period of 1 week are summarised in the frequency table below.

Length of phone call (t minutes)	$0 < t \leq 1$	$1 < t \leq 2$	$2 < t \leq 5$	$5 < t \leq 10$	$10 < t \leq 30$
Frequency	14	46	102	a	40

- (i) Find the value of a . [1]
- (ii) Calculate an estimate of the mean length of these phone calls. [2]
- (iii) On the grid, draw a histogram to illustrate the data in the table. [4]



Q8 s2018_p63

The masses in kilograms of 50 children having a medical check-up were recorded correct to the nearest kilogram. The results are shown in the table.

Mass (kg)	10 – 14	15 – 19	20 – 24	25 – 34	35 – 59
Frequency	6	12	14	10	8

(i) Find which class interval contains the lower quartile.

[1]

(ii) On the grid, draw a histogram to illustrate the data in the table.

[4]



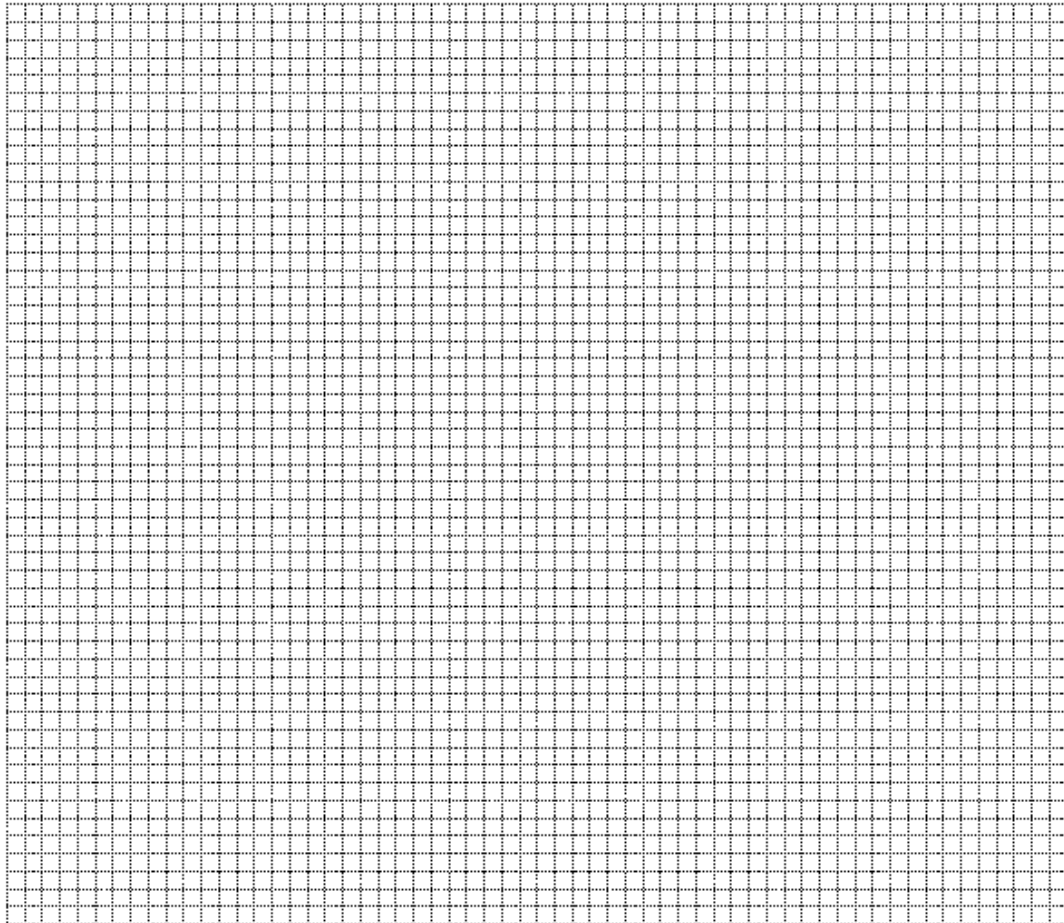
Q9 w2019_p62

The speeds, in km h^{-1} , of 90 cars as they passed a certain marker on a road were recorded, correct to the nearest km h^{-1} . The results are summarised in the following table.

Speed (km h^{-1})	10 – 29	30 – 39	40 – 49	50 – 59	60 – 89
Frequency	10	24	30	14	12

(i) On the grid, draw a histogram to illustrate the data in the table.

[4]



(ii) Calculate an estimate for the mean speed of these 90 cars as they pass the marker.

[2]

ANSWERS

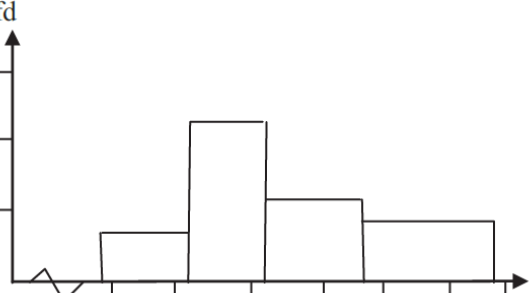
Q1 s2015_p61

(i)	UQ 5.5 – 7.0 cm	B1 [1]	
(ii)	fd 5.33, 25, 28, 20.7, 6, fd length in cm	M1 Attempt at fd or scaled freq [fr/cw] A1 Correct heights seen on graph B1 Correct bar widths no gaps B1 [4] Labels (fd and length/cm) and correct bar ends	

Q2 s2015_p63

(i)		B1	Uniform axes cf and nitrogen content labelled, at least 0 to 70 and 3.5 to 4.8 seen																		
		M1	5 points plotted correctly on graph paper																		
		A1	<table border="1"><tr><td>3.5</td><td>3.8</td><td>4.0</td><td>4.2</td><td>4.5</td><td>4.8</td></tr><tr><td>0</td><td>6</td><td>18</td><td>41</td><td>62</td><td>70</td></tr></table>	3.5	3.8	4.0	4.2	4.5	4.8	0	6	18	41	62	70						
3.5	3.8	4.0	4.2	4.5	4.8																
0	6	18	41	62	70																
		[3]	All points correct and a reasonable curve (condone 1 missed point) or line segments.																		
(ii)	70 – their 55 = 15 = 21.4%	M1	Subt a value > 41 from 70 (or $n/70$, $n < 29$)																		
		A1	Correct ans, accept 18.5 – 22																		
[2]																					
(iii)	median = 4.15	B1	Accept $4.1 < \text{median} < 4.2$, nfw																		
		[1]																			
(iv)	<table border="1"><tr><td>nit cont</td><td>3.5–3.8</td><td>3.8–4.0</td><td>4.0–4.2</td><td>4.2–4.5</td><td>4.5–4.8</td></tr><tr><td>fr</td><td>6</td><td>12</td><td>23</td><td>21</td><td>8</td></tr><tr><td>fd</td><td>20</td><td>60</td><td>115</td><td>70</td><td>26.7</td></tr></table>	nit cont	3.5–3.8	3.8–4.0	4.0–4.2	4.2–4.5	4.5–4.8	fr	6	12	23	21	8	fd	20	60	115	70	26.7	M1	Attempt at freqs, at least 3 correct, ignore labelling
nit cont	3.5–3.8	3.8–4.0	4.0–4.2	4.2–4.5	4.5–4.8																
fr	6	12	23	21	8																
fd	20	60	115	70	26.7																
		M1	Attempt at fd as f/cw only at least 3 correct FT (Accept $f/cw \times k$)																		
		A1	Correct heights seen on graph (plot at 4.8, 27 A0) Graph paper must be used (3 correct relative heights implies M1M1)																		
		B1	Correct bar ends seen on graph – graph paper used																		
		B1	Correct linear scale and labels.																		
		[5]																			

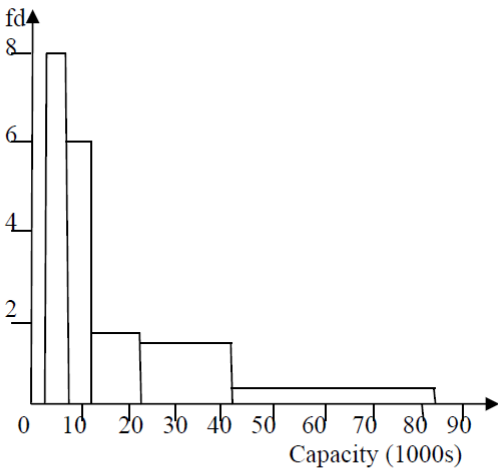
Q3 w2015_p61

(i) $a = 9/cw$ $= 9/2 = 4.5$ $1.5 = b/4$ so $b = 6$	M1 A1 A1 [3]	Using $fd = f/cw$ Correct a Correct b
(ii) 	B1 ✓ B1 B1 [3]	Correct heights fit their b Correct widths, ie 3, 2, 3, 4 starting either 60 or 59.5 Labels fd, time or minutes and squiggle and bars from 59.5 to 71.5

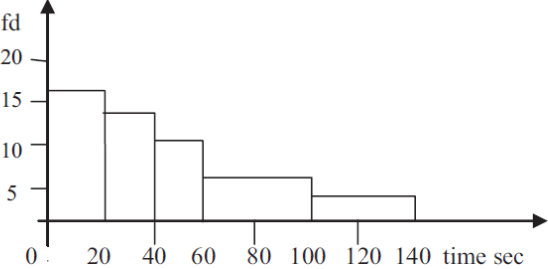
Q4 w2015_p63

(i) fd 0.9, 3, 4.2, 5.2, 1.4 ht metres	M1 Attempt at scaled freq [$f/(at\ attempt\ at\ cw)$] A1 Correct heights seen on diagram Scale no less than 1cm to 1 unit B1 Correct bar widths visually no gaps B1 4 Labels (ht/metres and fd or freq per 20m etc.) and end points at 20.5 etc. condone 2 end point errors, scale no less than 1cm to 5m for 20,30... unless clearly accurate, linear scale between 20.5 and 80
(ii) $\frac{(30.5 \times 18 + 43 \times 15 + 48 \times 21 + 55.5 \times 52 + 70.5 \times 28)}{134}$ $= \frac{7062}{134} = 52.701$ $Var = \frac{(30.5^2 \times 18 + 43^2 \times 15 + 48^2 \times 21 + 55.5^2 \times 52 + 70.5^2 \times 28)}{134} - 52.701^2$ $= 392203.5/134 - 52.701^2 = 149.496$ $sd = 12.2$	M1 Attempt at unsimplified, mid points (at least 4 within 0.5) M1 Attempt at Σfx their mid points $\div 134$ A1 Correct mean rounding to 53 M1 Attempts at Σfx^2 their mid points $\div$ their $\Sigma f - \text{mean}^2$ A1 5 Correct answer, nfw

Q5 w2016_p62

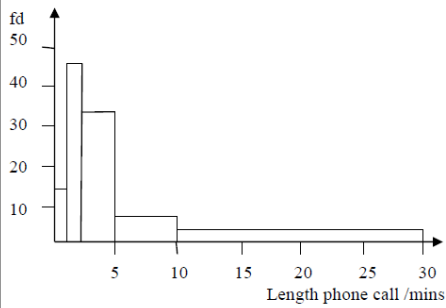
(i)	cw 5, 5, 10, 20, 40 fd 8, 6, 1.8, 1.7, 0.2	M1 M1	cw either 4 or 5 etc fd or scaled freq [f/their cw attempt] fd may be $\div 1000$
		A1 B1 B1	Correct heights seen accurately on diagram Correct bar ends, accurately plotted on axis [5] Labels fd and capacity (thousands) Correct horizontal scale required. Vertical scale linear from 0
(ii)	$(5 \times 40 + 10 \times 30 + 17.5 \times 18 + 32.5 \times 34 + 62.5 \times 8) / 130$ $= 2420 / 130 = 18.6 \text{ thousand}$	M1 A1	$\Sigma fx / 130$ where x is mid point attempt (value within class, not end pt or cw) [2]
(iii)	median group = 8 – 12 thousand LQ group = 3 – 7 thousand	B1 B1	Thousands not needed [2]

Q6 s2017_p61

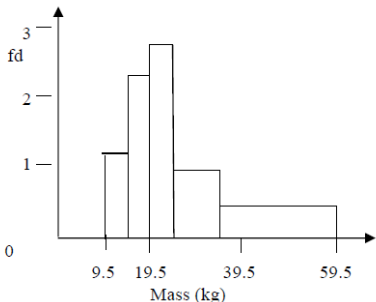
(i)	fd 16, 14, 11, 505, 2.5	M1 Attempt at fd (must be at least 3 freq/cw) – may be implied by graph
		A1 Correct heights seen on graph i.e. must see a gap for fd = 2.5 etc.
		B1 Correct end points of bars and correct widths
		B1 labels fd, sec. Time can be optional. Linear axes, condone $0 \leq t < 20$ etc.
	Total:	4

(ii)	$(10 \times 320 + 30 \times 280 + 50 \times 220 + 80 \times 220 + 120 \times 100) / 1140$	M1 using $\Sigma fx / n$ with mid-point attempt ± 0.5 , not ends not class widths
	= 45.8	A1
	Total:	2

Q7 s2018_p62

(i)	$a = 40$	B1	
		1	
(ii)	$\text{Mean} = \frac{0.5 \times 14 + 1.5 \times 46 + 3.5 \times 102 + 7.5 \times \text{their } 40 + 20 \times 40}{242}$ $= \frac{1533}{242}$	M1	Numerator: 5 products with at least 3 acceptable mid-points $\times$ appropriate frequency FT (i). Denominator: 242 CAO
	$= 6 \frac{81}{242}$ or 6.33	A1	CAO (6.3347... rounded to 3 or more SF)
		2	
(iii)	fd = 14, 46, 34, ($\frac{\text{their } (i)}{5} =$) 8, 2	M1	Attempt at fd [f/(attempt at cw)] or scaled freq
		A1FT	Correct heights seen on diagram with linear vertical scale from (x, 0) FT their $\frac{a}{5}$ only
		B1	Correct bar widths (1:1:3:5:20) at axis, visually no gaps, with linear horizontal scale from (0, y), first bar starting at (0, 0)
		B1	Labels (time, mins, and fd(OE) seen, some may be as a title) and a linear scale with at least 3 values marked on each axis. (Interval notation not acceptable)
		4	

Q8 s2018_p63

(i)	15–19 (kg) cao	B1	kg not necessary; condone 14.5 – 19.5
	Total:	1	
(ii)	fd = 1.2, 2.4, 2.8, 1, 0.32	M1	Attempt at fd [f/(attempt at cw)] or scaled freq (may be implied by 4 correct)
		A1	Correct heights seen on diagram with linear vertical scale from (x, 0)
		B1	Correct bar widths (1:1:1:2:5) visually no gaps with linear horizontal scale from (9.5, y) and first bar starting at (9.5, y)
		B1	Histogram, using attempted fds, with labels (mass, kg and fd seen) and at least 3 linearly spaced values on each axis. Horizontal axis must range from at least 9.5 to 59.5 If horizontal axis clearly starts from zero, either a break in the scale must be indicated or the scale must be linear from zero.

Q9 w2019_p62

(i)	0.5 2.4 3 1.4 0.4	M1	At least 3 frequency densities calculated (frequency ÷ class width) e.g. $\left(\frac{10}{20}, \frac{10}{19} \text{ or } \frac{10}{19.5}\right)$ may be read from graph using <i>their</i> scale, 3SF or exact
	All heights correct on graph.	A1	
	Bar ends of 9.5, 29.5, 39.5, 59.5, 89.5	B1	
	Axes labelled: Frequency density (fd) and speed/km h ⁻¹ (or appropriate title). Linear scales $9.5 \leq \text{horizontal axis} \leq 89.5$, $0 \leq \text{vertical axis} \leq 5$, 5 bars with no gaps	B1	
		4	
(ii)	$\frac{19.5 \times 10 + 34.5 \times 24 + 44.5 \times 30 + 54.5 \times 14 + 74.5 \times 12}{\text{their } 90}$ $= \frac{195 + 828 + 1335 + 763 + 894}{90}$ $= \frac{4015}{90} \text{ or } \frac{803}{18}$	M1	Uses at least 4 midpoint attempts (e.g. 19.5 ± 0.5). Allow unsimplified expression.
	$44\frac{11}{18}$ or 44.6 (km h ⁻¹)	A1	Final answer not an improper fraction NFWW
		2	